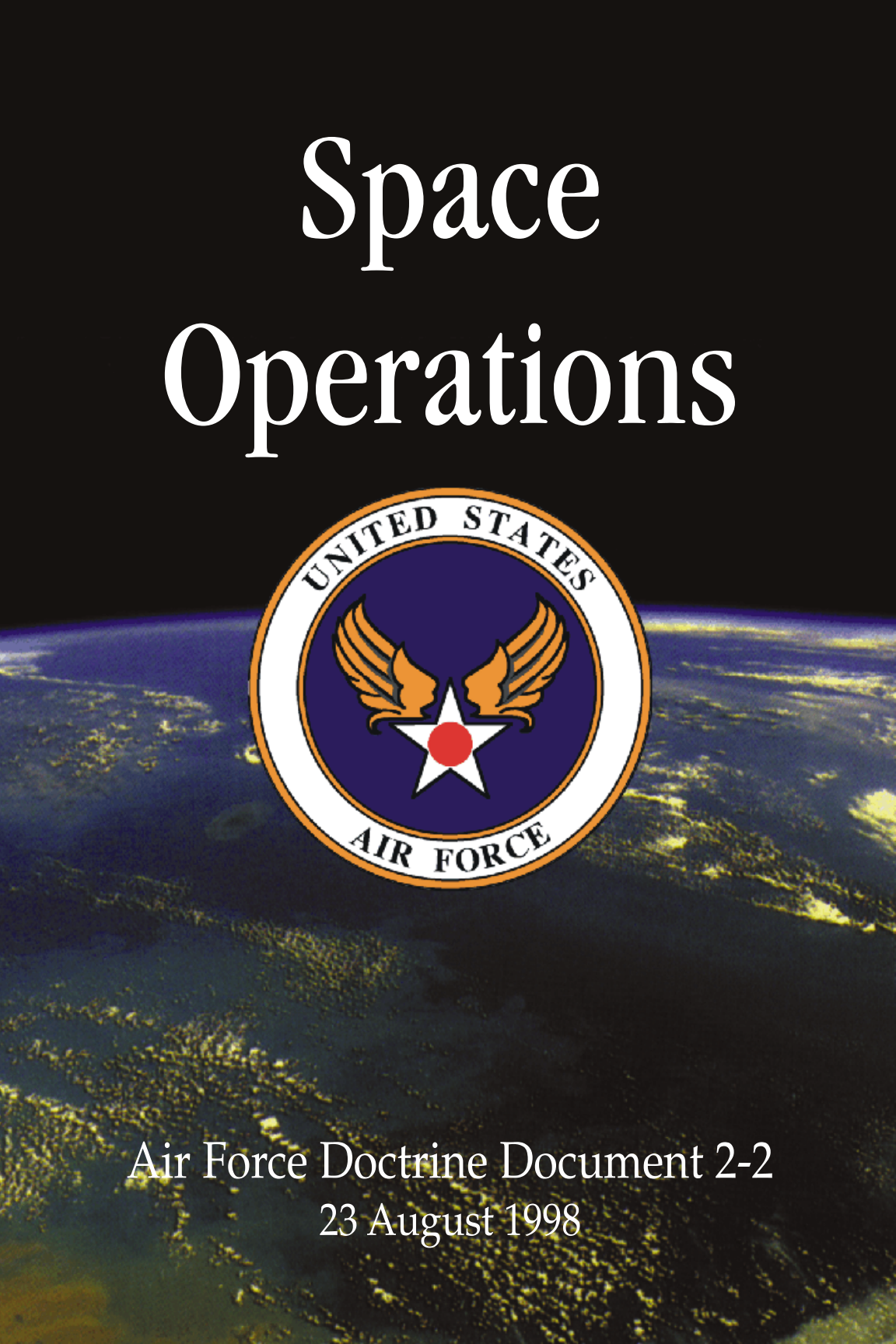
Space Operations



Air Force Doctrine Document 2-2

23 August 1998

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
23 AUG 1998	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Space Operations Air Force Doctrine Document 2-2	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **United States Air Force Pentagon Washington, DC**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**SAR**	**42**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

BY ORDER OF THE
SECRETARY OF THE AIR FORCE

AIR FORCE DOCTRINE DOCUMENT 2-2
23 AUGUST 1998

OPR: HQ AFDC/DR (Maj Jonathan C. Hines, USAF)
Certified by: HQ AFDC/CC Maj Gen Ronald E. Keys, USAF
Pages: 41
Distribution: F
Approved by: MICHAEL E. RYAN, General, USAF
Chief of Staff

FOREWORD

The United States is the world's foremost aerospace power, and our space forces are essential elements of that power. Space systems and capabilities enhance the precision, lethality, survivability, and agility of all operations – air, land, sea, and special operations. Space operations are key elements in achieving global awareness and maintaining information superiority. Space assets contribute significantly to overall aerospace superiority and support the full spectrum of military actions in theaters of operations.

The United States Air Force is an aerospace force comprised of both air and space systems and the people who employ and support these systems. *Space Operations* doctrine defines space's attributes and its contribution to aerospace power. This document provides employment concepts that integrate space capabilities into theater campaigns. *Space Operations* describes a command structure for responsive space force operations. As a keystone doctrine document, it underscores the seamless integration of space into the total aerospace effort.

MICHAEL E. RYAN
General, USAF
Chief of Staff

23 August 1998

CONTENTS

INTRODUCTION

PURPOSE

This Air Force Doctrine Document (AFDD) highlights specific principles and doctrine for space operations. It provides doctrine for the Air Force to organize, train, equip, and operate space forces.

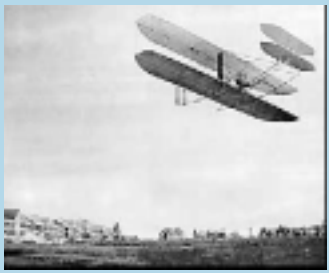
APPLICATION

This document applies to all Air Force agencies, including the Air National Guard, Air Force Reserve, and civilian personnel employed by the Air Force. The doctrine in this document is authoritative but not directive. Commanders should exercise judgment when applying this doctrine to accomplish their missions.

SCOPE

This doctrine expands upon basic Air Force beliefs and operating principles found in AFDD 1 and AFDD 2 and specifically relates those tenets of aerospace power to space operations.

Aerospace — Past to Present



Early use of the medium of air focused on reconnaissance and an airplane's ability to provide a broader perspective of the battle area to commanders. Air intelligence proved crucial to the outcome of the first battle of the Marne, early in World War I. Information supplied by air reconnaissance about German troop movements and location allowed French commanders to maneuver their troops and engage the enemy. The resulting battle halted the German army advance short of Paris and helped to prevent a swift German victory. During World War I and the interwar years, airpower grew from reconnaissance support to become a crucial ingredient for success in the modern warfare of World War II.

Space, a further extension of the medium of air, now provides an improved theater and global perspective of the world for today's leaders. Also, like early airplane use, early space development focused on reconnaissance and intelligence. Today, space systems are maturing from the equivalent of the biplane in World War I, to becoming a fully integrated part of our aerospace capability. This integrated aerospace medium is truly the ultimate high ground of today's military.

CHAPTER ONE

FOUNDATION OF SPACE POWER

> ***The air ocean and its endless outer space extension are one and indivisible . . .***
>
> **Alexander P. de Seversky**

GENERAL

The aerospace medium can be most fully exploited when considered as a whole. Although there are physical differences between the atmosphere and space, there is no absolute boundary between them. The same basic military activities can be performed in each, albeit with different platforms and methods. Therefore, space operations are an integral part of aerospace power. Space power is the capability to employ space forces to achieve national security objectives. Used effectively, space power enhances America's opportunities to succeed across the broad range of military operations. Space power is derived from the exploitation of the space environment by a variety of space systems. A key element of space power is the people who operate, maintain, or support these systems. Space affords a commanding view of operations and provides an important military advantage. At the level of basic aerospace doctrine, the principles that govern aerospace operations are the same for air and space.

SPACE CHARACTERISTICS

While the Air Force believes that space and air are a seamless continuum, the space environment has different characteristics from the air environment. The characteristics of space are sufficiently different from air that a complete understanding of both is required to leverage their contributions. Space-based forces operate in accordance with the laws of astrodynamics, while air forces operate in accordance with the laws of aerodynamics. Although there is no international agreement regarding the specific boundary between air and space, terrestrial-based forces generally operate below an altitude of roughly 100 kilometers; whereas, space-based forces operate above this altitude where the effects of lift and drag are negligible. Space-based forces operate in a

harsh environment characterized by high-energy particles and fluctuating magnetic fields and temperatures. Air forces operate in the Earth's atmosphere, with its temperature, moisture, wind, precipitation, and pressure differences. Airmen must understand both environments as they create an integrated aerospace operation.

SPACE SYSTEMS

Space systems consist of three elements: space, terrestrial, and link. The space element consists of the platforms for which astrodynamics is the primary principle governing movement. Examples include satellites, space stations, or the space shuttle. The terrestrial-based element consists of the land, sea, or airborne equipment used to communicate with and control the space element. The terrestrial-based element also includes the personnel required to operate and maintain equipment. Examples of the terrestrial-based element include ground stations, shipborne space communication nodes, or airborne space communications systems. The link element is the communication between the space element and the terrestrial-based element. Examples of the link element include data link signals. All three elements can be key factors in military operations.

Slow Down to Speed Up

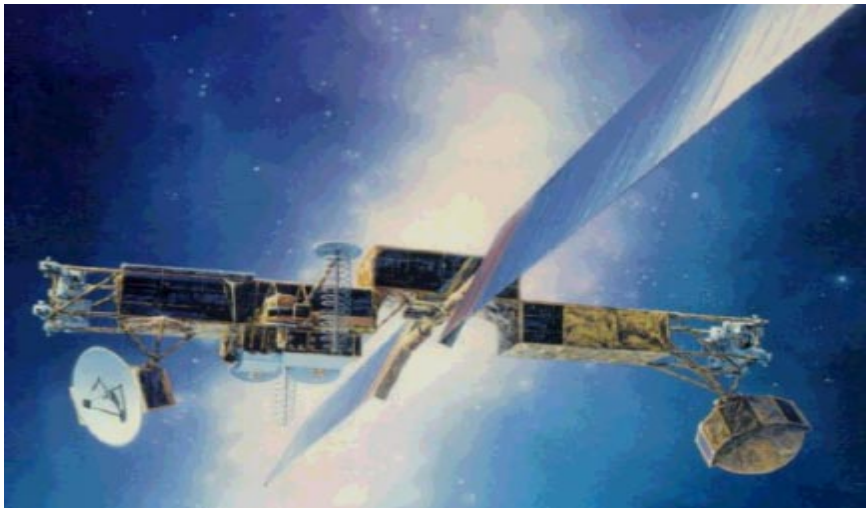
It sounds odd, but it is true for a satellite in orbit. How quickly a satellite circles the Earth is determined *only* by its altitude—high altitude circuits take longer to complete than low ones. Any attempt to "speed up" a satellite by applying more thrust will only push the spacecraft out to a higher orbit, thus increasing the *orbital period* (the time it takes to circumnavigate the globe).

To shorten the orbital period, the satellite must be allowed to fall into a lower orbit which requires *braking* (usually by firing a propulsion motor in the direction of flight). Satellites in low Earth orbit will complete more frequent revolutions around the Earth but cannot "linger" over any particular point. To cause a satellite to appear to stand still when seen from the Earth requires pushing the craft out to Geostationary Earth Orbit—a *geosynchronous* orbit 22,300 miles directly above the equator (a difficult proposition in terms of fuel costs).

Satellites that orbit at that altitude but are not directly above the equator will appear to make figure eights from center lines over the equator. The 24-hour orbital period of any geosynchronous orbit corresponds precisely with the time it takes the Earth to rotate once on its axis.

Space and terrestrial-based forces complement each other. Used properly, space forces are a significant force multiplier for terrestrial-based

forces. In addition to supporting terrestrial operations, many military functions previously performed by terrestrial forces may be accomplished by space forces. In some cases, space may be the focus of operations and may be supported by complementary terrestrial-based forces. As space and air forces are fully integrated into a total aerospace force, future space assets may not be only a force multiplier but may be the force of decision itself.



Military Strategic and Tactical Relay System (MILSTAR)

The development of communication satellites has revolutionized civilian and military communication capabilities over the last 25 years by providing rapid global information transfer. Maintaining freedom of use of these assets by US forces and denying communication capabilities to an adversary are critical to military operations.

CHAPTER TWO

COMMAND OF SPACE FORCES

Nothing is more important in war than unity in command

Napoleon Bonaparte

UNITY OF COMMAND

Centralized control and decentralized execution are essential to the successful and optimal use of aerospace power. Since space forces' effects and contributions are global in nature and include critical national assets, they are tasked and assigned from a global perspective. Theater commanders do not have actual physical control of the satellite, its control systems, or ground control nodes. However, in a regional conflict, theater commanders have control over accurate and timely products from space and normally have tactical control over space component equipment and its application in the area of responsibility (AOR).

SERVICE COMPONENT ASSETS

United States Space Command (USSPACECOM) is the unified command exercising control authority over Service space command components. Within USSPACECOM, the Fourteenth Air Force (14 AF) commander is the Air Force component commander designated to manage, integrate, and direct Air Force space forces. The 14 AF commander provides space support to theater forces as required or when requested. Currently, theater support teams augment the joint force air component commander's (JFACC) staff to provide space expertise to support planning and execution of air and space taskings or missions. As the Air Force moves to more integrated

Limited Assets Require Centralized Control

Aerospace power requires centralized control and decentralized execution in order to maximize the impact of valuable but limited resources across theaterwide requirements. Space power, as an integral part of aerospace power, likewise requires a centralized command and control approach to insure it can fulfill both its global and theater requirements and maximize its benefits.

aerospace operations, reliance on theater support teams will diminish as space specialists are assigned to permanent duty on numbered air force staffs.

ASSETS NOT ASSIGNED TO A SERVICE COMPONENT

Assets not assigned to a Service component provide an increasing portion of the space systems capabilities available to the theater commander. *These assets include, but are not limited to, US national systems, leased commercial assets, or multinational force assets.* They are closely linked to the air campaign planning and execution process for situational awareness and battlespace preparation. Command and control of these assets seldom follow the standard combatant command (command authority), operational control, or tactical control rules. To obtain the widest range of benefits available from these assets requires flexibility and innovation on the part of the commander.

CHAPTER THREE

SPACE FORCE OPERATIONS

> ***When blows are planned, whoever contrives them with the greatest appreciation of their consequences will have a great advantage.***
>
> **Frederick the Great**

GENERAL

Within the DOD, the Air Force is in the forefront of space operations. The Air Force provides essential support and expertise for space activities to other military departments and the civil sector. Air Force space operations are based on the core competencies and missions outlined in Air Force Doctrine Document 1, *Air Force Basic Doctrine*. Space force operations focus on controlling the space environment, applying force, conducting enabling and supporting operations for terrestrial-based forces, and supporting space forces.

Gaining air and space superiority is a primary goal of a military campaign and must be achieved early to ensure freedom of action. *Like air superiority, space superiority helps to provide the freedom to conduct operations without interference from an adversary. Hostile powers must not be permitted to freely use space systems against US national interests.* The US cannot permit an adversary access to precision navigation signals, instantaneous communications between leadership and subordinate echelons, situational awareness, accurate weather data, or a host of other services that are, or will be, available from space. In future conflicts the US may have to fight for space superiority.

Adversaries may have imaging and other space systems capable of monitoring operations and the ability to adversely affect US systems. American military leaders cannot afford to have enemy commanders monitor friendly force activities, locate critical command nodes, identify maneuver elements as they deploy for combat, or witness the debarkation of forces and supplies. This information would substantially facilitate an adversary's war planning and execution, which could result in casualties for friendly forces.

SPACE CONTROL

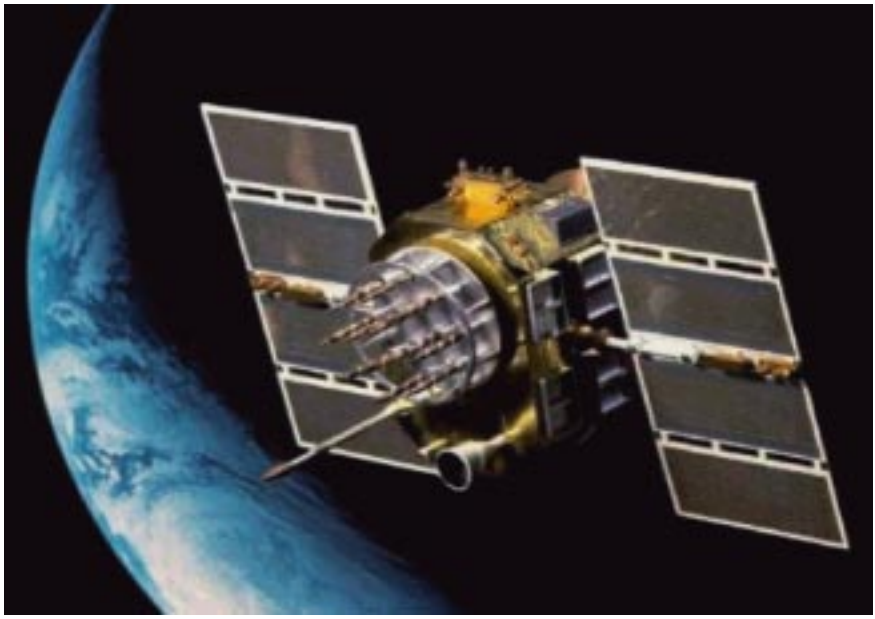
Space control is the means by which space superiority is gained and maintained to assure friendly forces can use the space environment while denying its use to the enemy. To accomplish this, space forces must survey space, protect the ability to use space, prevent adversaries from exploiting US or allied space services, and negate the ability for adversaries to exploit their space forces. *Counterspace is the mission carried out to achieve space control* objectives by gaining and maintaining control of activities conducted in or through the space environment. Counterspace involves activities conducted by land, sea, air, space, information and/or special operations forces. Counterspace includes offensive and defensive operations.

Offensive Counterspace

Offensive counterspace operations destroy or neutralize an adversary's space systems or the information they provide at a time and place of our choosing through attacks on the space, terrestrial, or link elements of space systems. *The principal means of conducting offensive counterspace operations is through the use of terrestrial-based forces such as air attacks against space system ground nodes or supporting infrastructure.* As the use of and investment in space increases, protecting resources is critical. Because such protection introduces the possibility of Earth-to-space, space-to-space, and space-to-Earth operations, it is in the national interest to be prepared to develop the capability to support multipurpose operations in the space medium and employ such systems as national policy dictates.

Offensive counterspace operations use lethal or nonlethal means to achieve five major purposes: *deception, disruption, denial, degradation, and destruction of space assets or capabilities*.

- *Deception consists of those measures designed to mislead the adversary by manipulation, distortion, or falsification of evidence to induce the adversary to react in a manner prejudicial to their interests.*
- *Disruption is the temporary impairment of the utility of space systems, usually without physical damage to the space segments.* These operations include delaying critical mission data support to an adversary. Given the perishability of information required to effectively command and control military operations, this disruption impedes the effective appli-



Global Positioning System (GPS) Satellite

The GPS constellation allows forces to navigate anywhere in the world. By using this system in the Gulf War, US troops were able to operate effectively in the trackless desert. The precision navigation capability of GPS greatly enhances military operations throughout the spectrum of operations.

cation or exploitation of that data. Examples of this type of operation include jamming or refusing or withholding data support or spare parts.

- *Denial is the temporary elimination of the utility of the space systems, usually without physical damage.* This objective is accomplished by such measures as denying electrical power to the space ground nodes or computer centers where data and information are processed and stored.
- *Degradation is the permanent impairment of the utility of space systems, usually with physical damage.* This option may include attacks against the terrestrial or space element of the space system. For example, a ground-based laser could be used to damage the optics of an imaging sensor without impairing other functions of the satellite bus.
- *Destruction is the permanent elimination of the utility of space systems, usually with physical damage.* This last option includes special operations forces (SOF) missions to interdict critical ground nodes, airpower

missions to bomb uplink/downlink facilities, and attacks against space elements with either kinetic-kill or directed-energy weapons.

Defensive Counterspace

Defensive counterspace operations consist of active and passive actions to protect US space-related capabilities from enemy attack or interference.

- *The objective of active defense is to detect, track, identify, intercept, and destroy or neutralize enemy space and missile forces.* Active defense operations include maneuvering the spacecraft, deploying mobile ground links and terrestrial-based elements, and deploying decoys. It may also include the employment of lethal protection methods.
- *The objectives of passive defense are to reduce the vulnerabilities and to protect and increase the survivability of friendly space forces and the information they provide.* Passive defense includes measures such as encryption, frequency hopping, and hardening. Space systems are also defended by camouflage, concealment, deception, redundancy, mobility, and dispersion.

Contributing Capabilities

Three capabilities are critical to the successful conduct of offensive and defensive counterspace operations: surveillance and reconnaissance of space, ballistic missile warnings, and understanding how the space environment may affect systems operating through or in space.

- **Surveillance and Reconnaissance of Space.** Surveillance and reconnaissance of space detect and identify space systems and help characterize the space threat environment. Space surveillance (broad area coverage) provides information vital to the reconnaissance (close scrutiny) of an area or objects of specific interest. Space surveillance identifies alterations in the space environment, such as changes in the order of battle and deployment or retirement of space systems. Information derived from both surveillance and reconnaissance data allows planners to identify where force application or space control is required. This support is necessary for targeting and situational awareness and directly supports the counterspace mission as well as the terrestrial conflict.
- **Ballistic Missile Warning.** Space-based systems and terrestrial-based sensors detect, track, and report on ballistic missile launches posing

potential threats against North America, geographic theaters of operation, and space-based assets. Ballistic missile warning provides critical information essential to the NCA decision process in determining an appropriate response to attack. Additionally, ballistic missile warning enhances the JFACC's counterair operations when conducting theater ballistic missile defense.

- **Space Environment Operations.** The space environment impacts systems operating through or in the space environment. Knowledge of the space environment helps warfighters avoid operations during times when space environment disturbances degrade space-based information; helps communicators choose the best frequencies, antenna angles, and transmission schedules; and allows spacecraft operators advanced notice of effects which may impact satellite and surveillance operations.

APPLICATION OF FORCE

The application of force would consist of attacks against terrestrial-based targets carried out by military weapon systems operating in space. *Currently, there are no force application assets operating in space, but technology and national policy could change so that force application missions could be performed from platforms operating in space.* For example, space systems such as the space-based laser could provide space-based attacks against terrestrial-based targets and provide timely suppression of enemy defenses to improve the penetration effectiveness of air assets. Space-based weapon systems that deliver this firepower may rely on other space-based systems for target acquisition, command and control, navigation, mid-course corrections, and terminal guidance. In addition to space-based systems, transatmospheric vehicles could also provide firepower to support future force application missions. **Such space systems will be used when it is consistent with national policy and they are the best methods to achieve the military objective.**

ENHANCING OPERATIONS

Force enhancement operations consist of those operations conducted from space with the objective of enabling or supporting terrestrial-based forces. *Navigation, communications, reconnaissance, surveillance, ballistic missile warning, and environmental sensing help reduce uncertainty and friction at all three levels of war—strategic, operational, and tactical.* Enabling and supporting space operations increase a force's ability to detect, plan, and react faster than an adversary. Force enhancement must

include consideration of civil, commercial, and allied space support that can augment DOD space systems. These enhancements consist of data, data relay, analysis, or other enabling capabilities. Appendix A depicts notional space operations and support that enhance the lethality, precision, agility, and survivability of combat forces.

SUPPORTING SPACE FORCES

Space force support is carried out by terrestrial-based elements of military space forces to sustain, surge, and reconstitute elements of a military space system or capability. *These activities deploy, sustain, or augment on-orbit spacecraft, direct missions, and support other government or civil organizations.* Space force support involves spacelift and satellite operations.

Spacelift

Spacelift provides the Air Force with the ability to project power by delivering satellites, payloads, and material into or through space. *The Air Force uses a combination of military, DOD civilian, and civilian contractor personnel to process, integrate, assemble, check out, and launch space vehicles.* Civil and commercial contributions further expand the number of launch sites available to spacelift. During periods of increased tension or conflict, a spacelift objective is to launch and deploy new or replacement space assets and capabilities as necessary to achieve national security objectives. Air Force spacelift operations are conducted to deploy, sustain, or augment satellite constellations supporting US military operations.

- **Launch to deploy** is a strategy defined as a launch, or series of launches, required to initially achieve a satellite system's designed operational capability. This includes initial constellation deployments and research and development launches. This strategy uses a launch-on-schedule approach where launches are planned in advance and executed in accordance with the current launch schedule.
- **Launch to sustain** is a strategy to replace satellites predicted to fail or that fail abruptly.
- **Launch to augment** is a strategy to increase operational capability above the designed operational capability in response to war, crisis, or contingency. This strategy is considered in conjunction with other systems that may provide similar capabilities.

Regardless of the launch strategy employed, planners must consider current satellite capabilities, residual assets possessing degraded utility, and reconstituted capabilities. Incorporating all of these capabilities helps ensure adequate force structure is available to satisfy operational requirements. **The quality and capability of civil, commercial, and allied systems which augment military operations are a key determinant in the launch strategy adopted.**

Delta II Rocket

This system launches civil and commercial payloads into low-earth, polar, geotransfer and geosynchronous orbits.

Satellite Operations

The Air Force Satellite Control Network (AFSCN) provides a means to maneuver, support, and sustain on-orbit forces. *The AFSCN is a worldwide network of single-system and multiple-system facilities and sensors which provides telemetry, tracking, and commanding (TT&C) support, conducts network processes, and distributes mission data for virtually all DOD and US civilian spacecraft and selected foreign space programs.* AFSCN satellite support generally falls into three categories: 1) low-orbit vehicles which require high levels of support; 2) medium-altitude vehicles which may require support only once every other revolution; 3) high-altitude vehicles which, depending on satellite requirements, need minutes to hours of support every day. The AFSCN also supports ballistic missile warning and suborbital test launches.

CHAPTER FOUR

ATTRIBUTES OF SPACE POWER

> ***Today, the ultimate high ground is space.***
>
> **General Joseph W. Ashy**

GENERAL

The Air Force is unique in its ability to capitalize on the contributions of space systems by being able to integrate and respond with rapid mobility and firepower to the near-real-time information afforded by systems operating in space. The systems that operate in space offer several useful attributes.

GLOBAL COVERAGE

Space-based systems in appropriate orbital deployments provide worldwide coverage and frequent access to specific Earth locations, including those denied to terrestrial-based forces, on a recurring basis. *Unconstrained by political boundaries, satellites deployed in specific orbits and in sufficient numbers maintain a continuous presence over enemy territory.* For example, three surveillance satellites in geostationary orbit provide surveillance of almost the entire Earth's surface. Twenty-four navigation satellites placed in semisynchronous orbit enable terrestrial-based forces anywhere on the Earth to be within line of sight of the necessary three satellites to obtain three dimensional precision navigation. *Space systems provide an instantaneous presence not available from terrestrial-based forces, permitting the United States to leverage information to influence, deter, or compel an adversary or affect a situation.* The use of multiple space platforms allows warfighters to exploit the various sensors, resulting in a synergistic battlespace perspective that reduces the fog of war. *Although space systems provide global coverage, some can be focused to provide information on specific areas of interest*, which can improve situational awareness and planning tempo and can enable information dominance for all friendly military forces. By exploiting comprehensive space capabilities, space forces can focus on and provide detailed services for a specific geographic area and support regional planning requirements. The attribute of global coverage offers significant advantage to Air Force battle manage-

ment. *Properly positioned in sufficient numbers, space-based systems could provide a global capability for much of the information currently provided by airborne platforms such as the joint surveillance, target attack radar system (JSTARS) and the Airborne Warning and Control System (AWACS).*

Defense Support Program (DSP) satellite

DSP has provided global missile warning coverage for the United States since the early 1970's and was a key warning system for Scud missile launches during the Gulf War.

FLEXIBILITY

Space systems provide flexibility in meeting requirements for timely, accurate, and reliable space-derived information, data products, and services. For example, today's satellite systems perform continuous tasks such as navigation, communications, and surveillance. Operationally, they can adapt to new situations through on-orbit, real-time reprogramming. Modifying terrestrial processing operations and modifying replacement satellites being readied for sustainment launches provide further flexibility options. *The Air Force has concluded that in the near future, autonomous space system operations, from peace through all levels of conflict, will be cost-effective, operationally responsive, and less complicated. For the more distant future, uninhabited transatmospheric vehicles may provide additional flexibility in performing complex missions.*

ECONOMY

Despite the large initial investments in hardware and lift, over time some functions are performed more economically from space. For example, global communications are generally more economical when operated from space. Similarly, global weather forecasting would require numerous ground-based or aerially deployed weather sensors around the world if weather data were not available from space.

EFFECTIVENESS

Some activities such as wide area surveillance are more effective when they are conducted from space. *Additionally, the absence of atmosphere and attenuation provides an optimum operating medium for future directed energy weapons such as lasers and particle beams that travel at the speed of light with great range.* Absence of atmospheric drag also enables objects to obtain high velocities that provide tremendous kinetic energy, which could be used, for space-to-space weapons. The ability to initially obtain high velocities prior to encountering atmospheric drag also allows for high kinetic energy space-to-Earth weapons. The use of space in the future as an actual war-fighting medium will provide unlimited range, rapid deployability, and unprecedented accuracy in addition to superior situational awareness. **Space enhances the simultaneous employment of both dominant maneuver and precision engagement operational concepts by either supporting terrestrial-based operations or providing an opportunity for independent asymmetric employment of forces.**

Defense Meteorological Satellite Program (DMSP)

The DMSP is used for collecting weather data for US military operations and has served in this capacity for more than two decades in support of both peacetime and wartime planning and targeting requirements.

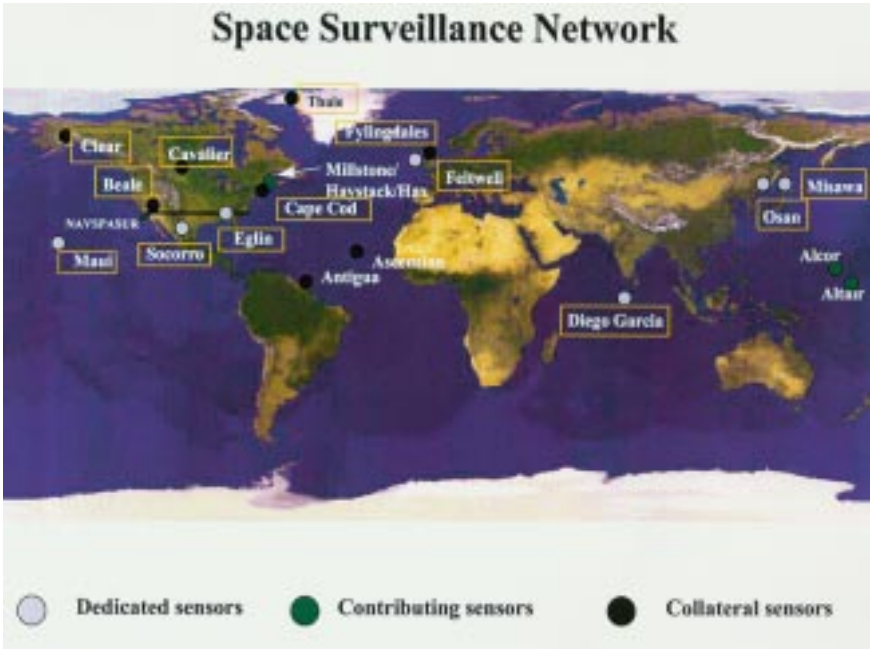


Figure 4.1. Space Surveillance Network (SSN)

The SSN has been tracking space objects since 1957 when the Soviets opened the space age with the launch of Sputnik I. Since then, the SSN has tracked more than 24,500 space objects orbiting Earth. Of that number, the SSN currently tracks more than 8,000 orbiting objects. The rest have re-entered Earth's turbulent atmosphere and disintegrated, or survived re-entry and impacted the Earth. The space objects now orbiting Earth range from satellites weighing several tons to pieces of spent rocket bodies weighing only 10 pounds. About seven percent of the space objects are operational satellites, the rest are debris. USSPACECOM is primarily interested in the active satellites, but also tracks space debris. The SSN tracks space objects which are 10 centimeters in diameter (baseball size) or larger.

ROBUSTNESS

Functions accomplished by space-based and terrestrial-based systems, using both air and space assets, provide mutual backup and complicate hostile attempts to neutralize our overall military capability. However, an adversary's ability to conduct counterspace missions precludes the space medium from being a sanctuary for our space systems. The current threat against our space systems focuses

on attacks against the terrestrial and link elements of a space system. Emerging threats to the space element of our space systems include direct ascent anti-satellite (ASAT) weapons, ground-based lasers, space mines, electronic warfare, exoatmospheric nuclear bursts, and cyberattack. Therefore, the defense of our space systems is critical to sustain space operations and maintain redundancy among terrestrial and space systems.

CHAPTER FIVE

SPACE EMPLOYMENT CONCEPTS

> ***Airmen throughout the world have learned that the capability to control the air above the earth's surface permits freedom of movement on the land and seas beneath. As we progress into space, I feel sure that our capability to control space will assure freedom of movement on the earth and through the earth's atmosphere.***
>
> **General Thomas D. White**

ROLE OF MILITARY SPACE POWER

As an integral element of national capabilities, space systems influence operations throughout the conflict spectrum. *Space supports Service, joint, and multinational operations across the range of military operations, from peacetime engagement to general war. Space forces contribute at all levels of military activity—strategic, operational, and tactical.* They give our national leaders the presence and war-fighting options needed for power projection. Space forces develop, operate, and maintain mission capability through spacelift, satellite operations, utilization of space systems, and the exploitation of space-derived information. The national security space program collects information critical to America's national security. Additional support for military operations can be gained through prudent planning for and use of civil, commercial, and allied space systems.

PEACETIME, DETERRENCE, AND MILITARY OPERATIONS OTHER THAN WAR

Space forces provide arms control verification data, indications and warning, attack warning of air or ballistic missile strikes on the United States and its allies, surveillance and reconnaissance of space systems controlled by adversaries, and critical command and control communications. Space forces play a significant part in our ability to characterize threats and identify an adversary's strengths, weaknesses, and vulnerabilities for our national leaders to use in diplomatic, political, and economic efforts. Data and information derived from space forces are often critical decision-making elements that can provide global situational

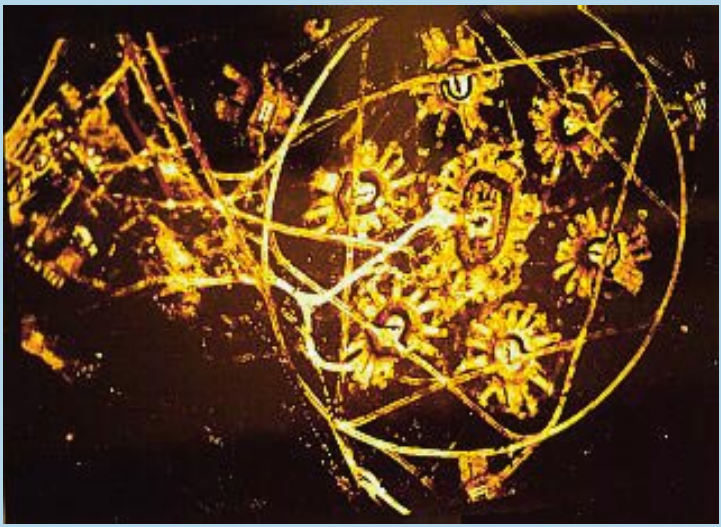
awareness and diplomatic advantage and can permit the United States to respond effectively to evolving crises. Military operations other than war (MOOTW) can be applied to complement any combination of the other instruments of national power. *Space forces directly support military and civil leaders performing all sixteen representative types of MOOTW described in joint doctrine*. Employment of space forces must be responsive to meet the needs of these leaders and the needs of other military and civil agencies performing both combat and noncombat MOOTW.

ESCALATION CONTROL

As crises escalate, space systems provide data and objective information that can help our leaders accurately appraise the situation and implement appropriate diplomatic, economic, and military measures to defuse or respond to the crisis. *Our use of military forces and capabilities as national power elements permits us to take effective actions prior to war that reflect our resolve to support friends, allies, and national objectives and interests*. During MOOTW, space forces are employed to shift the balance of power in a regional crisis to deter war, resolve conflict, or promote peace. Timely intelligence data could be provided to one or both sides in a potential conflict area to reduce tensions. If these efforts fail, *space forces directly support the deployment, employment, and redeployment of military forces and the conduct of combat operations.*

SPACE OPERATIONS SUPPORT DURING CONFLICT

In the future, the US may not have the opportunity for extended mobilization of military forces in preparation for war; therefore, **space support for military forces involved in regional crises and conflicts will initially be accomplished using currently deployed space forces. Additional space forces will be integrated into the theater commensurate with the requirements of the theater commander and available assets.** The ability of space forces to collect, process, and disseminate timely strategic, operational, and tactical information on the enemy's forces is essential to expeditionary forces who must fight effectively in potentially unfamiliar terrain against an unfamiliar enemy. Conversely, allowing an enemy access to information on US force deployments, order of battle, movements, and logistics may jeopardize our ability to stage and deploy forces and to successfully execute our military strategy.



Cuban Missile Crisis

This photo, taken on November 10, 1962, was President Kennedy's favorite of all those taken during the Cuban missile crisis. Clearly shown are Soviet-built SA–2 surface-to-air missiles (SAMs) in place at launch sites. These defensive missiles protected offensive weapons sites and posed a serious threat to US reconnaissance aircraft. A copy of this portion of the strip photo was mounted in the President's office. Viewed with a stereoscopic projector, the features have a three-dimensional effect. The pattern of dots surrounding several launch sites are actually camouflage nets which were intended to conceal the equipment positioned beneath them, but which the strip camera rendered ineffective.

During the crisis, the intelligence data supplied to decision makers was crucial. Objective data from various sources allowed the President to begin diplomatic efforts immediately. The administration took actions that clearly showed US resolve, which the Soviets were able to verify through their own means. The information provided before, during, and after the crisis was critical to the peaceful outcome.

INFORMATION SUPERIORITY

The ability to control an enemy's information can be decisive in military operations. *This means integrated information superiority becomes a prerequisite strategic objective for future combat.* It will focus on asymmetric warfare where our forces will possess a greater understanding of the strengths, weaknesses, interdependencies, and centers of gravity of an

adversary's military, political, social, and economic infrastructure than the adversary has of our own sources of national power.

Failure to attain information superiority early in the crisis or conflict could mean the difference between success or failure of diplomatic initiatives, crisis resolution or war, and the ability to maintain the element of surprise during military operations. Therefore, the ability of our integrated aerospace forces to attain information superiority widens the gap between friendly actions and adversary reactions and allows friendly commanders to manage the adversary's decision cycle by controlling and manipulating the information available to them. This asymmetric warfare, based on an information advantage, coupled with dynamic battle control methods, permits our forces to redirect actions in real time to blunt or destroy adversary offensive military operations before they can reach our forces. *This approach can be decisive in modern combat, save lives, and exploit America's advantage in technology and tactical operations.*

POSTHOSTILITIES

Postconflict actions include the period in which nations return to a peaceful state and reestablish legitimate governance over their people. During military operations, critical civil infrastructure such as communications systems and navigation aids may be destroyed. Space systems can provide these critical services while indigenous communications systems, navigation aids, and other systems are rebuilt. Space systems may provide the only means to conduct these activities in the posthostilities phase.

CHAPTER SIX

SPACE POWER FOR THE THEATER CAMPAIGN

> ***Desert Storm...was a watershed event in military space applications because for the first time, space systems were both integral to the conflict and critical to the outcome of the war.***
>
> **General Thomas S. Moorman, Jr.**

SPACE OPERATIONS INTEGRATION

Commanders must integrate and optimize all available space forces to effectively employ aerospace power. Aerospace operations use terrestrial-based and space-based assets to gain air and space and information superiority to support the theater CINC's campaign objectives. Full spectrum dominance, space control, and force enhancement tasks critical to theater planning are highlighted in Appendix A.

COUNTERSPACE PLANNING FACTORS

The theater CINC can direct the employment of air, land, sea, space, and special operations forces against the adversary's space forces by targeting enemy terrestrial space and link elements. *Adversary space forces to be targeted include data links, launch sites, booster storage facilities, communications links, TT&C nodes, satellites, and launch vehicles*. The theater CINC's ultimate target is the adversary's access to space services, which will be neutralized by whatever means is most effective. These targets are coordinated with all elements of the joint campaign plan to ensure control of the activities conducted in space.

THEATER PLANNING AND OPERATIONS SUPPORT

Theater planners need to understand the enabling and supporting capabilities that reside in space forces. *They must ensure their requirements are clearly identified so space forces can be effectively, efficiently, and coherently focused on theater planning and integrated into mission execution*. Planners may require access to national system information and other space-related data.

2d Space Warning Squadron (2 SWS)

The 2d Space Warning Squadron at Buckley Air National Guard Base, Aurora, Colorado, is assigned to the 21st Space Wing, Peterson Air Force Base, Colorado . The 2d SWS ground station processes Defense Support Program Data and controls Defense Support Program satellites in Earth's orbit vital to USSPACECOM's space support mission.

PEACETIME PLANNING

In peacetime, planners ensure that when a crisis erupts in any theater, forces are fully prepared to use all space systems efficiently. Space systems should be used to full advantage and tailored to the unique situation in that theater. Planners ensure sufficient and appropriate user equipment is available to provide access to space capabilities and to support the full range of military operations. Appendix A depicts notional space capabilities that should be considered for operation plans (OPLAN). Through an aggressive cross-flow program, space personnel are integrated in staff positions within the unified command staffs and their components. Individuals with national and military space expertise provide the knowledge to obtain, employ, and exploit space power. Combining the knowledge of aerospace power experts helps to ensure aerospace power is interoperable and properly integrated for the JFC.

CRISIS AND WARTIME SPACE OPERATIONS

Air Force Space Support Teams (AFSSTs) deploy to support regional planning staffs when requested. They provide space power expertise to assist in planning and execution functions while providing additional liaison channels between USCINCSPACE and the theater CINCs. Normally, AFSSTs work through the JFACC to provide space support. Unified theater support teams provide an interface to coordinate the employment and exploitation of space forces with other elements of the JFC's overall campaign plan and are assigned to the JFC's staff. As the Air Force moves to more integrated aerospace operations, reliance on theater support teams will diminish as space specialists are assigned to permanent duty on numbered air force staffs.

At the very Heart of Warfare lies doctrine…

Space Control	Enhancing Operations				
	Surveillance/ Reconnaissance	Navigation	Environmental Sensing	Communication	Theater Missile Warning
Provide a space order of battle *Detect attack and provide warning to space forces* *Defend against attack against space forces* *Detect, report, and track ballistic missile launches* *Disrupt, deny, degrade, and destroy adversary space surveillance capabilities* *Deny adversary access to US/ allied space systems*	*Detect artificial disturbances (e.g., buried facilities, construction sites, etc.)* *Locate pre-surveyed missile launch locations* *Provide route and target information for mission planning* *Detect camouflage (artificial soft disturbances)* *Assess enemy movements, operations*	*Provide common navigation grid* *Provide common timing reference* *Provide position, location, velocity for weapon accuracy, and ingress and egress* *Provide position, location, time for navigation, and silent rendezvous coordination*	*Provide data for radiation fallout patterns, intensity, and aerosol dispersion* *Provide wind and cloud temperature, and atmospheric moisture data in enemy area for weapon selection* *Monitor ionospheric disturbances and weather conditions which affect C4I* *Provide weather data over route and target*	*Provide raw data to assessment centers* *Provide assessed information to key decision makers* *Provide warning to forces* *Provide secure, survivable communications* *Provide taskings to forces* *Provide intertheater and intratheater communications*	*Detect, report, and track ballistic missile launches*

Space Control	Enhancing Operations				
	Surveillance/ Reconnaissance	Navigation	Environmental Sensing	Communication	Theater Missile Warning
Deceive, disrupt, deny, degrade, or destroy space platforms, payloads, sensors, links, launch facilities, satellite control, or information distribution centers as required by CINCs *Deploy decoys, on-orbit spares, and residual capabilities as required to support military operations*	*Provide warning of hostile acts and reconnaissance against US assets* *Detect, track, assess, and report air-breathing threats* *Detect, assess, and report nuclear detonations*		*Provide soil moisture, location of ice floes, precipitation, temperature, and snow cover data for trafficability* *Provide multispectral imagery data for maps and analysis* *Monitor solar wind and magnetic fields* *Determine when scintillation of US communication systems might occur*	*Provide assessed information and data to forces* *Provide timely situational awareness and location information to forces* *Provide status of forces*	

Appendix A cont. Notional Space Power Capabilities

SUGGESTED READINGS

Daniel Goure, & Christopher M. Szara, *Air and Space Power in the New Millennium* (Center for Strategic and International Studies), 1997.

Michael J. Muelo, & (ed) Richard Hand, Bonnie Houchen, Lou Larson, Jeff Walters, *Space Handbook* (Air University Press), 1993.

David Lupton, *On Space Warfare* (Air University Press), 1988.

Michael H. Gorn, *Harnessing the Genie, Science and Technology Forecasting for the Air Force 1944-1986* (Office of Air Force History), 1988.

Mark C. Cleary, *The Cape: Military Space Operations, 1971–1992* (45th Space Wing, History Office), 1994.

Joan Johnson-Freese, and Roger Handberg, *Space, the Dormant Frontier: Changing the Paradigm for the 21st Century* (Praeger), 1997.

Michael R. Mantz, *The New Sword: A Theory of Space Combat Power* (Air University Press), 1995.

Curtis Peebles, *High Frontier: The U.S. Air Force and the Military Space Program* (Air Force History and Museums Program), 1997.

Bob Preston, *Plowshares and Power: The Military Use of Civil Space* (National Defense University Press), 1994.

Peter Hayes, *Space Power Interests* (Westview Press), 1996.

David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership* (Air Force Space Command), 1997.

United Nations, *United Nations Treaties and Principles on Outer Space: text and status of treaties and principles governing the activities of states in the exploration and use of outer space, adopted by the United Nations General Assembly* (Office for Outer Space Affairs, United Nations), 1994.

GLOSSARY

Abbreviations and Acronyms

AFDD	Air Force Doctrine Document
AFSCN	Air Force Satellite Control Network
AFSST	Air Force Space Support Team
AOR	area of responsibility
ASAT	anti-satellite
AWACS	Airborne Warning and Control System
CINC	commander of a combatant command; commander in chief
DMSP	Defense Meteorological Satellite Program
DOD	Department of Defense
DSP	Defense Support Program
JFACC	joint force air component commander
JFC	joint force commander
JSTARS	joint surveillance, target attack radar system
MILSTAR	military strategic and tactical relay system
MOOTW	military operations other than war
NCA	National Command Authorities
OPLAN	operation plan
SOF	special operations forces
SSN	space surveillance network
SWS	space warning squadron
TT&C	telemetry, tracking, and commanding
US	United States
USCINCSPACE	Commander in Chief, United States Space Command
USSPACECOM	United States Space Command

Definitions

associated space infrastructure—The equipment and personnel required to acquire, field, and sustain space forces.

link element—The electromagnetic energy used to convey data and information between the space element and the terrestrial element.

space element—A platform in which astrodynamics is the primary principle governing its movement through its environment.

space power—The capability to exploit civil, commercial, intelligence, and national security space systems and associated infrastructure to support national security strategy and national objectives from peacetime through combat operations.

space system—A system with a major functional component which operates in the space environment or which, by convention, is so designated. It usually includes a space element, a link element, and a terrestrial element.

terrestrial-based element—The land-, sea-, or air-based equipment and personnel used to receive, transmit, and process data from, or to control, the space element of a space system.


You are the
United States Air Force

Headquarters Air Force Doctrine Center
Maxwell AFB, Alabama
1998